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A REVIEW OF ONTARIO HYDRO'S
ACID GAS REPORT

1989

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A
REVIEW OF
ONTARIO HYDRO'S
ACID GAS REPORT

PREPARED JOINTLY BY
THE MINISTRY OF THE ENVIRONMENT AND
THE MINISTRY OF ENERGY

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1. EXECUTIVE SUMMARY

Ontario's Countdown Acid Rain Regulation 281/87 requires Ontario Hydro to reduce its acid gas emissions to 215,000 tonnes a year by 1994. This total represents a 60 per cent reduction from Hydro's peak emission level in 1982 and must be maintained regardless of future growth in electricity demand.

The Program also required Ontario Hydro to report, by January 31, 1989, on the options available to meet the acid gas limits, and on the reasoning used in selecting the preferred options from among those examined, in sufficient detail to permit the government to review them.

Ontario Hydro submitted its report, entitled "Options Available to Meet Acid Gas Limits and Selection of Preferred Options" (henceforth "the Report"), on January 25, 1989.

Ontario Hydro's Report

In the period 1990 to 1993, Countdown Acid Rain requires Ontario Hydro's operations to reduce acid gas emissions from 430,000 tonnes per year to the interim limit of 280,000 tonnes per year.

During this period the Corporation will expand its use of fuels with lower sulphur content, and also increase its efforts to reduce electricity demand through conservation, efficiency measures and non-utility generation.

Ontario Hydro will also commission the Darlington Nuclear Generating station which will offset the need for generation at coal-fired stations.

Starting in 1994, the emission cap is reduced to 215,000 tonnes per year. To meet this stricter limit Ontario Hydro plans to commission its first two scrubbers at the Lambton generating station by 1994. Conservation and efficiency measures, non-utility generation and hydraulic generation will also be employed, and low sulphur fuels will be used.

To stay within the legal limits as electricity demand increases, Ontario Hydro calls for another pair of scrubbers to start operation in 1996 at Lambton, two more in 1997 at Nanticoke followed by another pair at Nanticoke in 1998. Additional hydro-electric power and new "clean" generation will also become available.

Ontario Hydro's plan to attain pollution cuts by 1994 and maintain the cap through the year 2000 will cost an estimated \$2.46 billion in dollars-of-the-year. This will result in increased electricity rates beginning in 1990 and peaking at a 2.9 per cent increase in 1998.

The Government Review

The Ministries of Environment and Energy believe that the Report outlines the options reasonably available to Ontario Hydro and that the plan should allow Ontario Hydro to meet Ontario's acid gas control regulation.

In its consideration of the available options Ontario Hydro has attempted to maximize its flexibility to ensure compliance with the regulation and to meet future electricity requirements. The Ministries of Environment and Energy agree that this flexibility is appropriate.

The reviewers agree that in the short term, Ontario Hydro should proceed with the installation of the first two scrubbers at Lambton by 1994, (subject to necessary Environmental Assessment and detailed project approvals). Other measures as outlined in Ontario Hydro's Report, such as the use of lower sulphur fuels, efficiency and conservation measures, encouragement of non-utility generation, installation of low-NO_x burners, firm purchases from Manitoba and new hydro-electric generation, are valuable components in reducing acid rain, and should be accepted in principle.

Over the medium and long term, further consideration should be given to alternative approaches identified by Ontario Hydro, particularly with respect to a greater contribution from conservation, growth of non-utility generation and an expanded use of natural gas. Consideration of these and other issues are suitable for discussion in the context of the upcoming review of Ontario Hydro's Demand Supply Plan which will examine all the options available to meet Ontario's electricity needs to the year 2010. This review will help to ensure that Ontario Hydro not only meets the regulated emission limits for the years after 1994, but also uses a mix of options consistent with Ontario's environmental, social and economic goals.

The process which will be set in place will ensure that the Demand Supply Plan will reflect Government policy on matters such as "Conservation First." The process will also provide opportunities for public consultation.

Ontario Hydro should provide information through the Ministries of Environment and Energy on a number of matters raised in this review of Ontario Hydro's Acid Gas Plan, including the rationale for acid gas abatement measures considered but not selected, and a comparison of the incremental costs and benefits of targeted levels for conservation, energy efficiency, non-utility generation and demand management measures with the incremental costs and benefits of flue gas desulphurization and the construction or renovation of new or existing coal-fired generation.

A full examination in the context of the Demand Supply Plan would then place the government in a position of being able to endorse all the elements of Ontario Hydro's acid gas abatement report.

To date, Ontario Hydro has met all the acid gas limits imposed by Regulation 281/87.

2. ONTARIO'S COUNTDOWN ACID RAIN REGULATIONS

Ontario passed the Countdown Acid Rain regulations in December 1985. Amendments were made to the Hydro regulation in 1987 which removed "emission banking" provisions and converted the voluntary delivery of six-month progress reports into a legal requirement, in line with the stipulations for the other three major acid gas polluters in Ontario.

An emission cap of 885 thousand metric tonnes (kt) was established for the province for 1994, and individual caps and reduction schedules were put in place for each of the four major acid gas sources, which together

emit over 80 per cent of Ontario's sulphur dioxide. The regulations cover the nickel-copper smelters of Inco and Falconbridge in Sudbury, the Algoma iron ore sintering plant in Wawa, and the fossil-fuelled electricity generating plants of Ontario Hydro, province-wide¹.

Ontario's strategy is consistent with the federal-provincial acid rain reduction program covering the seven eastern provinces which comprise the eastern half of Canada. A separate set of rules and regulations, based on local conditions and shorter time periods, protects ambient air quality.

Under the Countdown Acid Rain program, Ontario's Hydro's emissions of both sulphur dioxide and nitric oxide (SO₂ and NO) were reduced in three steps, and compare to peak emissions of 531 kt of acid gases in 1982 (450 kt of SO₂ and 81 kt of NO).

Legal Limits for Ontario Hydro's Acid Gas Emissions
(kilotonnes per year)

	<u>SO₂</u>	<u>SO₂ + NO_x</u>
1986-1989	370	430
1990-1993	240	280
1994+	175	215

¹ A complete description of Ontario's program may be found in the Countdown Acid Rain information kit available through the Communications Branch, Ontario Ministry of the Environment, 135 St. Clair Avenue West, Toronto, Ontario, M4V 1P5 (416-323-4321). A separate government Summary and Analysis review of reports from the three metallurgical companies is also available.

A three year research and development phase was established, during which progress reports were required every six months. This planning phase ended January 31, 1989 and Ontario Hydro submitted its detailed implementation plan which is the subject of this report. In the interim, actual emissions have been within the regulated limits.

3. INTRODUCTION

Ontario Hydro provides almost all of the province's electricity. Hydro predicts an installed generation capacity of 32,400 MW by 1993 comprising nuclear (43 per cent), hydro-electric (20 per cent) and fossil fuel (37 per cent). However, actual energy production will comprise nuclear (61 per cent), hydraulic (22 per cent), and fossil fuel (17 per cent). Coal-fired generation will make up 73 per cent of the fossil fuel generating capacity with oil providing 18 per cent and natural gas a maximum of 9 per cent². The nuclear and most of the hydro-electric units are base load³ generation while the fossil fuel plants and some hydro-electric capacity are reserved for peaking⁴ duty. Coal is the swing fuel on

² 1987 Bulk Energy System Demand/Supply Report, Ontario Hydro Report 666SP, December 1987

³ BASE LOAD GENERATION: Those generating facilities within a utility system which are run as much as possible in order to minimize system operating costs. Except for maintenance periods, base load generation is usually run all the time.

⁴ PEAKING CAPACITY (or, Peaking Plant): Generating stations which are normally operated only to provide power during maximum load periods.

Ontario Hydro's system, it is used to meet demands beyond those that can be met by base load generation. Coal-fired generation also provides most of Ontario Hydro's reserve capacity which is required to meet contingencies.

Ontario Hydro's acid gas emissions since 1980 are presented in Table 1. Regulation 281/87 under the Environmental Protection Act requires Ontario Hydro to reduce these emissions to 280,000 tonnes in 1990 and to 215,000 tonnes in 1994.

TABLE 1
Ontario Hydro's Acid Gas Emission
(kilotonnes)

	1980	1981	1982	1983	1984	1985	1986	1987	1988
SO ₂	396	418	450	438	444	337	270	332	321
NO	66	71	81	77	75	61	50	62	60
=====									
TOTAL									
ACID GAS	462	489	531	515	519	399	320	394	381

Ontario Hydro was asked to report on the options for meeting the limits and the reasons for selecting a preferred approach. This report was to be the culmination of a three year period during which progress reports were issued every six months, and was to be a thorough review of all the options available to Ontario Hydro to reduce acid gas emissions. As the six-monthly reviews of Ontario Hydro's progress reports had noted, for the period 1990-1999 these options include:

- the increased use of low sulphur coal;
- flue gas desulphurization (FGD) and other retrofit control technologies;
- the commissioning of new hydro-electric generation in Ontario;
- major purchases of power from Quebec and Manitoba;
- additional private generation over existing targeted amounts;
- additional conservation over existing targeted amounts;
- the commissioning of currently approved new nuclear capacity at Darlington;
- increased use of natural gas.

This review considers the extent to which Ontario Hydro's acid gas abatement plan deals comprehensively with the issues.

4. ONTARIO HYDRO'S REPORT

Ontario Hydro's Report outlines its plan for meeting the acid gas control regulation through:

- Energy efficiency measures. (Demand management to replace 3,500 MW of capacity which equals a 12 per cent reduction in estimated energy demand by 2000).
- 1,000 MW of load shifting capacity from peak demand times as a result of time of use rates.
- 1,000 MW of additional private sector or non-utility generation capacity by 2000. (Providing about 4 per cent of Hydro's energy demand).
- 1,100 MW of new hydro-electric generation.

- Firm purchase of 200 MW of hydro electric power from Manitoba, beginning in 1998.

All of these measures had been targeted previously for system planning purposes.

Ontario Hydro also proposes to spend \$2.46 billion, between now and 2000, on:

- The retro-fit of scrubbers on 8 units at Lambton and Nanticoke (about 4,000 MW of scrubbed coal capacity by 1998) at an estimated cost of \$1.6 billion (including OM&A).
- Further flue gas conditioning to allow increased use of low sulphur coal.
- Low-NO_x controls installed at Lambton and Nanticoke.
- All non-scrubbed plants would burn low-sulphur coal (less than 1 per cent) by 2000.
- Continued burning of low-sulphur oil at Lennox.

The plan states that, should they be required, additional contingency measures are also available at an increased cost. These measures include natural gas use at the Hearn station, more oil use at Lennox and reductions of export sales.

5. EVALUATION OF OPTIONS

Table 4.2 in the Report gives information on the relative costs of the options. The Ministry of Energy met with Ontario Hydro during the development of its plan to discuss on the costs of the various options and in particular the costs of options such as conservation, non-utility generation and natural gas co-firing. The government reviewers were concerned that some options were dropped without a proper methodology for comparing their cost-effectiveness.

In its analysis of the costs of the options, Ontario Hydro has assigned zero costs for conservation and non-utility generation (NUG) up to the target levels of 2000 MW of strategic conservation and 1000 MW of NUG. Over the target levels the full costs of the measures were assigned to acid gas control. This resulted in costs of \$4,000 per tonne of acid gas removed for conservation and \$5,000 per tonne for NUG. These costs do not credit the electricity produced or saved by these options. Credits should be given for fuel savings in the short term and capacity replacement in the long term to ensure that a least-cost abatement path is followed.

Ontario Hydro's analysis of natural gas co-firing also showed it to be more expensive than scrubbers when considered solely as a mechanism for reducing acid gas emissions. Uncertainty in regard to natural gas prices makes it difficult to determine the effectiveness of this option as a means of reducing emissions.

Reviewers from the Ministry of the Environment were concerned that Hydro's plans should fit in with the government's existing environmental regulations, policies and initiatives. Specifically, the Ministry of

the Environment strongly supports maximum conservation and requires that any measures to abate acid gas do not result in the corporation being in conflict with other environmental regulations or policies.

As a general comment, the government reviewers noted that the Report expresses present and future emissions as a rate per kWh over the whole system. This may be technically correct, but it can be misleading, since expansion of system-wide supply automatically changes the ratio even if no emission reductions take place. The claim of "more electricity and less emissions" is correct in this context but the total tonnage emission of acid gas is the figure of interest for protecting the environment.

Non-Utility Generation and Gas-Fired Generation

Non-utility generation offers a number of advantages for Ontario's electricity system. For example, non-utility generation:

- allows more efficient use of energy, as in utilizing surplus process steam produced by natural gas in industrial cogeneration;
- increases use of our indigenous and renewable resources;
- contributes to Ontario's energy supply capacity without adding significantly to the size or cost of the Bulk Electricity System;
- improves diversity and flexibility; and,
- allows the expansion of our supply capacity in small increments.

Non-utility generation may also reduce acid gas emissions through the displacement of coal-fired generation.

Proposed amendments to the Power Corporation Act and a Memorandum of Understanding between Ontario Hydro and the Minister of Energy provide a framework for discussing the role that non-utility generation should play in meeting Ontario's future electricity requirements.

Within this framework the Ministry of Energy is in the process of preparing a policy on non-utility generation in Ontario. A key element of this policy is the consideration of a higher target for non-utility generation implementation by Hydro. Ministry analysis has determined that 2000 MW could be economically developed by the year 2000.

Ontario Hydro, in expectation of the Government's policy on non-utility generation, has now indicated that non-utility generation will be pursued and that as customers make their plans known, Hydro will modify its plans accordingly.

Natural gas can be used as the sole fuel in combined cycle cogeneration or privately-owned (or Hydro-owned) plants, and for co-firing with other fuels. In considering the use of cogeneration or gas-firing of plants as an element in an acid gas control strategy, the Ministry of Energy recognizes that there are risks associated with gas price increases.

A more thorough analysis of a range of possible strategies for using natural gas as an acid gas abatement measure should be considered within the context of the Demand Supply plan.

Most non-utility generation will be natural gas cogenerators or combined cycle facilities. The emissions from non-utility generation compare very favourably to coal-fired plants (scrubbed or unscrubbed) because gas is a low sulphur fuel. Ontario Hydro's 1988 emissions from coal-fired plants amounted to about 11,500 tonnes per TWh (teraWatt hour), of which over 85 per cent was SO₂. In comparison, a typical gas-fired combined cycle plant would produce about 830 tonnes of acid gas emissions per TWh, almost exclusively in the form of NO_x. As an acid gas control option compared with current coal emissions, non-utility generation therefore appears to offer a net benefit of about 10,600 tonnes per TWh.

In comparison with the cost of scrubbers (at \$1200 per tonne removed), it would appear that non-utility generation could be credited with an additional 1.3 cents per kWh to have an equivalent cost to scrubbers; (10,600 tonnes/TWh x \$1200/tonne = \$12,720,000/TWh = \$0.013/kWh).

Ontario Hydro correctly credits non-utility generation with about 8 TWh of contribution to the electricity supply in the year 2000. This corresponds to an installed non-utility generation capacity of 1000 MW, with the attendant acid gas emission reduction of about 85,000 tonnes per year.

Ontario Hydro's acid gas emissions in 1988 were 381 kilotonnes. To meet the 1994 requirement, Hydro's emissions need to be reduced by 166 kilotonnes per year from the 1988 level. Ignoring safety margins or system flexibility requirements, this reduction could be achieved through development of about 2000 MW of non-utility generation (1000 MW more than Hydro currently plans).

Role of Electricity Conservation

Conservation can provide significant benefits to the environment. For example it can:

- reduce emissions of acid gas, greenhouse gases and other toxic contaminants
- conserve resources
- move society closer to sustainable development.

In addition, electricity conservation can produce benefits in terms of reducing costs of fuel and other operational costs, offsetting the need for expansion and improvements to the transmission and distribution systems, and replacing or postponing the need for some new generation.

Ontario Hydro is committed to pursuing conservation and efficiency measures to targeted levels judged to be economic when compared to other supply alternatives. In view of the uncertainties related to the success of demand management programs, Hydro has been cautious about the planned impact of its activities to the degree outlined in the Report. Success in conservation efforts would increase Ontario Hydro's flexibility in dealing with acid gas emissions.

Ontario Hydro's Report recognizes the important role that conservation and efficiency measures can play in reducing acid gas emissions. Demand management includes efforts to reduce peak demand, increase energy efficiency, and reduce overall demand through conservation. Concerns about the local and global environment further support conservation. For every kilowatt conserved, virtually all emissions associated with it are avoided.

The Report has also identified some 1000 MW of peak demand that will be reduced as a result of Ontario Hydro's loadshifting plan.

Ontario Hydro, in June 1988, provided "A Plan for Electricity Conservation and Efficiency Measures" to the Minister of Energy. This set targets of 1500 MW of information driven conservation and 2000 MW of incentive driven conservation by the year 2000. A little over \$1 billion of spending on incentives was outlined in documents provided with this June 1988 plan. Table 9.1 in the Acid Gas Report lists "up to \$3 billion spent on incentives to 2000."

Conservation, beyond 2000 MW, was judged by Hydro to be a costly option. Ontario Hydro's analysis showed that additional conservation, done solely for the purpose of reducing acid gas emissions, could cost \$4000 per tonne. As previously noted, during the Demand Supply Planning process, incremental costs and benefits of conservation should be compared to the incremental costs and benefits of scrubbing or the construction or renovation of new or existing generating stations.

It is recognized that the pursuit of electricity conservation will involve outlays of funds. However, conservation and increased efficiency of electricity use bring benefits to the environment and the provincial economy. Electricity conservation reduces all emissions from coal and oil-fired generation. Ontario Hydro estimates that programs for strategic conservation can capture 2000 MW on a \$1 billion budget. In theory, more conservation is possible if more money were spent. The Ministry of Energy recently sponsored a study that showed that over 6000 MW of peak could be saved by cost-effective conservation measures.

The above issues should be discussed in detail in the context of the Demand Supply Plan, and information provided to the Ministries of Environment and Energy, before the approval is given to the second phase of Ontario Hydro's acid gas control plan.

Need for Flexibility

Ontario Hydro's approach is to regard coal-fired plants as critical to the safe and reliable operation of Ontario's electricity system. They are seen as essential for meeting peak demand and for responding to contingencies. This is understandable in view of the need to meet the electricity needs of the province.

However, the value of flexibility in meeting the acid gas limits was not explicitly dealt with in Hydro's Report. Therefore, it is impossible to judge whether a plan that maximizes flexibility is more desirable than plans which take other approaches.

Scrubber Program

Demand growth predictions forecast greater utilization of Ontario Hydro's coal-fired plants beginning in the mid-1990's.

This increase in coal burning requirements coincides with a tightening of Ontario's acid gas emission regulations.

In order to meet these two requirements, Ontario Hydro plans to retrofit up to eight scrubbers by the year 1998 to remove SO₂ from the exhaust of coal-burning plants, subject to approval of the Desulphurization Program under the Environmental Assessment Act and subsequent approval of detailed Project Implementation Reports by the Ministry of the Environment.

The first two SO₂ flue gas scrubbers are slated for operation at Lambton in 1994, with up to six more to be installed by 1998 (two at Lambton and four at Nanticoke). Depending on demand growth, as many as 12 units could be retrofitted with scrubbers in order to meet the regulated emission limit.

The Report, based on the most recent load forecasts and fossil generation requirements, notes that the number of scrubbers needed was increased from six to eight by 1998, with in-service dates for each pair of units in 1994, 1996, 1997 and 1998. This reflects higher load forecasts and a downgrading of the estimated FGD availability from 95 per cent to 90 per cent.

The Report refers to five other reports, including Ontario Hydro's Flue Gas Desulphurization (FGD) Environmental Assessment (EA). The EA requests permission to install any of four types of desulphurization technology to any of the 20 coal-fired units at the Lambton, Nanticoke and Lakeview plants.⁵

The four systems are:

- limestone slurry;
- limestone dual alkali;
- lime spray dryer;
- sorbent furnace injection.

Hydro's Report on its acid gas plans presented an opportunity for Hydro to indicate which FGD options will be implemented at which plant, based on Hydro's assumptions regarding power station usage, total coal burned, and costs of options, in order for a judgement to be made as to which combination of options is appropriate for each station.

However, it is recognized that the Government's decision on the EA is still under consideration. The reviewers also note Ontario Hydro's comments that timely approval of the EA is critical to the success of Hydro's acid gas abatement plan. Ontario Hydro's EA timetable requires government approval by July 1989.

⁵ Provision is made in Section 9 of the FGD Program EA for the substitution of newer, more effective abatement technologies, should they become available. Depending on the nature of the EA amendments requested, a separate EA could be required. In any event opportunities for public consultation and external notification are incorporated into the amendment process.

Implementation of the program components in the EA requires submission to and Government approval of a Project Implementation Report (PIR). The Project Implementation Process will ensure that actions proposed by Ontario Hydro meet the on-site requirements of the Ministry of the Environment.

The Ministry of the Environment reviewers felt it would be inappropriate to use a lower-efficiency sorbent furnace injection scrubbing system at any plant operating at more than a marginal level, particularly in view of the announced \$1.1 billion lifetime extension program at Lakeview. This concern has been obviated by the recent agreement between Ontario Hydro and the Canadian Coalition on Acid Rain which limits the use of such systems.

Coal Switching

Flue gas conditioning, which permits low sulphur coal to be burned by upgrading existing electrostatic precipitators to accommodate different ash loading will be installed at Lambton and Nanticoke units by 1990. Flue gas conditioning equipment will be installed at the Lakeview plant by 1990. This sulphur trioxide conditioning is not directly an acid gas control measure, but if successful, it will hence maintain adequate particulate capture permitting the burning of more low sulphur coal.

The source of new supplies of low sulphur coal is not stated in the Report. Greater use of low sulphur coal should be addressed during the upcoming Demand Supply Plan process.

The combustion of coal results in the emission of SO₂, NO_x, particulates, CO₂, trace metals, PAHs and dioxins. Any change in the operation of a coal-fired plant that may affect the emission of any of these pollutants is a serious matter. The switching of coals is one such change in operations as evidenced by the fact that Hydro has had to update its electrostatic precipitators (using SO₃ conditioning) to account for changes in fly ash from the low sulphur coals.

Ontario Hydro's emissions from the combustion of new coal are required to be in compliance with existing ambient air quality regulations (Ontario Regulation 308 under the Environmental Protection Act).

Nitrogen Oxides

Ontario Regulation 281/87 combines NO emissions with SO₂. The regulation has a limit for total annual SO₂, and a second limit for the aggregate total of SO₂ plus NO.

Recent international attention on pollution from nitrogen oxides has resulted in the Bulgarian Protocol calling for a world-wide freeze on the NO_x emission level. In accordance with this protocol Canada and Ontario are investigating ways to accomplish the required reductions. The majority of NO_x produced in Ontario in 1986 came from the transportation sector (66 per cent). Ontario Hydro contributed about 15 per cent.

Hydro has installed NO_x abatement technology in the form of low-NO_x burners at Nanticoke. Further control of nitric oxide (NO) emissions will be achieved by installing low NO_x burners at Lambton. An overall

reduction of 4-14 kt is predicted. Hydro is planning on implementing other NO_x control, beyond the use of low-NO_x burners. Selective catalytic and non-catalytic reduction are two such systems.

The increase in private, or non-utility generation will shift some of the burden of acid gas emissions from Hydro to the private sector. The current acid gas regulation applies to Ontario Hydro emissions and not the emissions that result from private generation.

6. CONCLUSIONS

1. Ontario Hydro's strategy is capable of meeting the limits imposed by the Countdown Acid Rain Program.
2. The Corporation has investigated a reasonable range of options for meeting the acid gas emission regulations.
3. Ontario Hydro should include, in the detailed information to be supplied to the Ministers of Environment and Energy:
 - the rationale for acid gas abatement measures considered but not selected
 - the targets for energy efficiency, demand management, non-utility generation and conservation measures, and the incremental cost and benefits of these measures compared to the incremental cost and benefits of FGD and the construction or renovation of new or existing coal-fired generating stations.

This information is required to enable a sound judgement to be made on the most effective mix of options.

4. Following considerations of the above information and other points raised in this review, the government would be in a position to evaluate Ontario Hydro's plan to remain within Countdown Acid Rain limits.
5. Ontario Hydro should proceed with its plans for the installation of the first two scrubbers at Lambton subject to Environmental Assessment approval and acceptance of the detailed Project Implementation Plans. The Lambton scrubbers are necessary to ensure that Ontario Hydro will meet the 1994 emission limits.
6. Other components of Ontario Hydro's plan to meet the acid gas emission limits by 1994, including conservation and efficiency measures, encouragement of non-utility generation, new hydro-electric generation, increased use of lower sulphur coal and commissioning of Darlington are acknowledged. The extent to which each component should be used will be considered in the upcoming Demand Supply Plan.
7. Ontario Hydro's Demand Supply Plan, which will be subject to full government and public review, should provide detailed information against which to assess the cost effectiveness of abatement options beyond the first set of scrubbers at Lambton, in the context of electricity system planning decisions and the need for and degree of coal-fired generation.
8. Non-utility generation and conservation are important mechanisms for reducing the need for Ontario Hydro electricity generation with consequent reductions in acid gas emissions.

9. The success of additional conservation and non-utility generation efforts will produce further benefits in terms of reduced acid gas emissions as well as other benefits.
10. Ontario Hydro has stated its firm commitment to the Government's "Conservation First" policy. A similar commitment is expected in response to the Government's parallel generation policy which is presently being developed.
11. Ontario Hydro, the Ministry of Energy and the Ministry of the Environment should seek to improve communications and consultations as a means of ensuring that Hydro is aware of Government policy relating to the environment and that Government is aware of Hydro's activities which have an impact on the environment. Improved consultation at staff level, during the development of strategies and plans, would also help to speed up the approval process.
12. While allowing Ontario Hydro to meet their regulated limits, combustion-based non-utility generation will transfer the responsibility for the emission of certain pollutants from Ontario Hydro to others not subject to the present Regulation 281/87. The Ministry of the Environment wishes to ensure that complete information on the projected NO_x and SO₂ emissions from non-utility generation is made available by non-utility generators, and that emissions from NUGs are accounted for in the provincial abatement strategy. Ontario Hydro should report on its actual and expected NUG agreements to the Ministry of the Environment.

13. Changes in Hydro's operations, notably fuel switching, called for in their acid gas abatement strategy could result in increased emissions of other pollutants. Information should be provided by Ontario Hydro to the Ministry of the Environment on the expected extent of these changes, in advance.

APPENDIX A

ADDITIONAL INFORMATION REQUESTED BY THE MINISTRY OF THE ENVIRONMENT

To provide additional clarification to the requirements of Regulation 662/85, (which preceded the current regulation) the Deputy Minister of the Environment sent a letter to the Chairman of Ontario Hydro in July 1986 outlining specific areas for the Report to address. The Report did not respond to these issues as expected, and the outstanding concerns are listed below, under the same headings as in the letter of 1986.

Research and Development Required to Meet the Regulated Limit:

The Research and Development plan is not clearly defined. The Report is too general in most of its description of solutions and does not elaborate on anticipated areas of future research. The technical content of the Report, in this respect, is very limited.

SO₂ and NO Emission Levels:

A quarterly compilation of SO₂ and NO levels was not shown in the Report, as requested. The annual figures were also not broken out.

Methods Selected to Achieve the Emission Limits:

Separate descriptions of SO₂ and NO_x abatement measures tended to be vague and general. This should be remedied in future reports.

There is no discussion of the effects on local and work place environments, except to the extent that they are covered for flue gas desulphurization matters in the EA document.

As previously noted, there is no identification of abatement measures considered but not selected and the rationale for not selecting them.

Contingency measures are covered by the general assurance that the plan is robust, and by noting that "more expensive control measures such as natural gas use at the Hearn station, oil at Lennox and reductions of export sales will be available in reserve". Details should be provided.

Capital and Operating Costs Required to Meet the Emission Limits:

These costs were not addressed in the detailed way requested. Presentation of cost data in cumulative dollars of the year, totalled for the Corporation, does not permit detailed analysis.

Financial and Socio-Economic Considerations:

The details requested are partially given, but rate impacts are not broken down by sectors. Some employment and economic effects are dealt with in the EA, but not for the non-FGD elements.

Technical Developments:

Research areas are mentioned in the Report but no specific details and/or potential benefits from these projects, if successful, are discussed.

APPENDIX B

ONTARIO REGULATION 281/87

REGULATION MADE UNDER THE ENVIRONMENTAL PROTECTION ACT

ONTARIO HYDRO

1. Emissions of sulphur dioxide and of nitric oxide from the fossil-fuelled electric generating stations of Ontario Hydro shall not exceed, in the aggregate, 430 kilotonnes in 1987, 1988 or 1989.

2. Emissions of sulphur dioxide and of nitric oxide from the fossil-fuelled electric generating stations of Ontario Hydro shall not exceed, in the aggregate, 280 kilotonnes in 1990, 1991, 1992 or 1993.

3. Emissions of sulphur dioxide and of nitric oxide from the fossil-fuelled electric generating stations of Ontario Hydro shall not exceed, in the aggregate, 215 kilotonnes in any year after 1993.

4. Emissions of sulphur dioxide from the fossil-fuelled electric generating stations of Ontario Hydro shall not exceed, in the aggregate, 370 kilotonnes in 1987, 1988 or 1989.

5. Emissions of sulphur dioxide from the fossil-fuelled electric generating stations of Ontario Hydro shall not exceed, in the aggregate, 240 kilotonnes in 1990, 1991, 1992 or 1993.

6. Emissions of sulphur dioxide from the fossil-fuelled electric generating stations of Ontario Hydro shall not exceed, in the aggregate, 175 kilotonnes in any year after 1993.

7. Ontario Hydro shall perform such studies and research as are necessary to determine the options available by which it can meet the limits prescribed in sections 1 to 6.

8.-(1) Ontario Hydro shall file, starting with the 1st day of June, 1987, written reports with the Ministers of Energy and the Environment by the 1st day of March, June, September and December in each year setting out the total of the emissions of sulphur dioxide and nitric oxide from the fossil-fuelled electric generating stations for the three-month period ending on the last day of March, June, September and December immediately before the filing of the report.

(2) Ontario Hydro shall file, starting with the 31st day of July, 1987, written reports with the Ministers of Energy and the Environment by the 31st day of January and July in each year setting out the progress being made for purposes of the limits specified in sections 1 to 6.

(3) If a report with information in sufficient detail so that the Lieutenant Governor in Council can review the options available to Ontario Hydro to meet the limits specified in sections 3 to 6 and the reasoning of Ontario Hydro in selecting its preferred option to meet those limits has not been filed with the Ministers of Energy and the Environment by the time the report to be filed under subsection (2) by the 31st day of January, 1989, is filed, then that report shall contain such information.

9. Ontario Regulation 662/85 is revoked.

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Explanatory Notes: The original Countdown Acid Rain regulation for Ontario Hydro (O. Reg. 662/85) contained provisions for the "banking" of emissions in certain circumstances. These provisions were removed. The emission limits and dates of implementation were not changed.

Also, a new provision was added requiring quarterly progress reports, previously provided on a voluntary basis.

